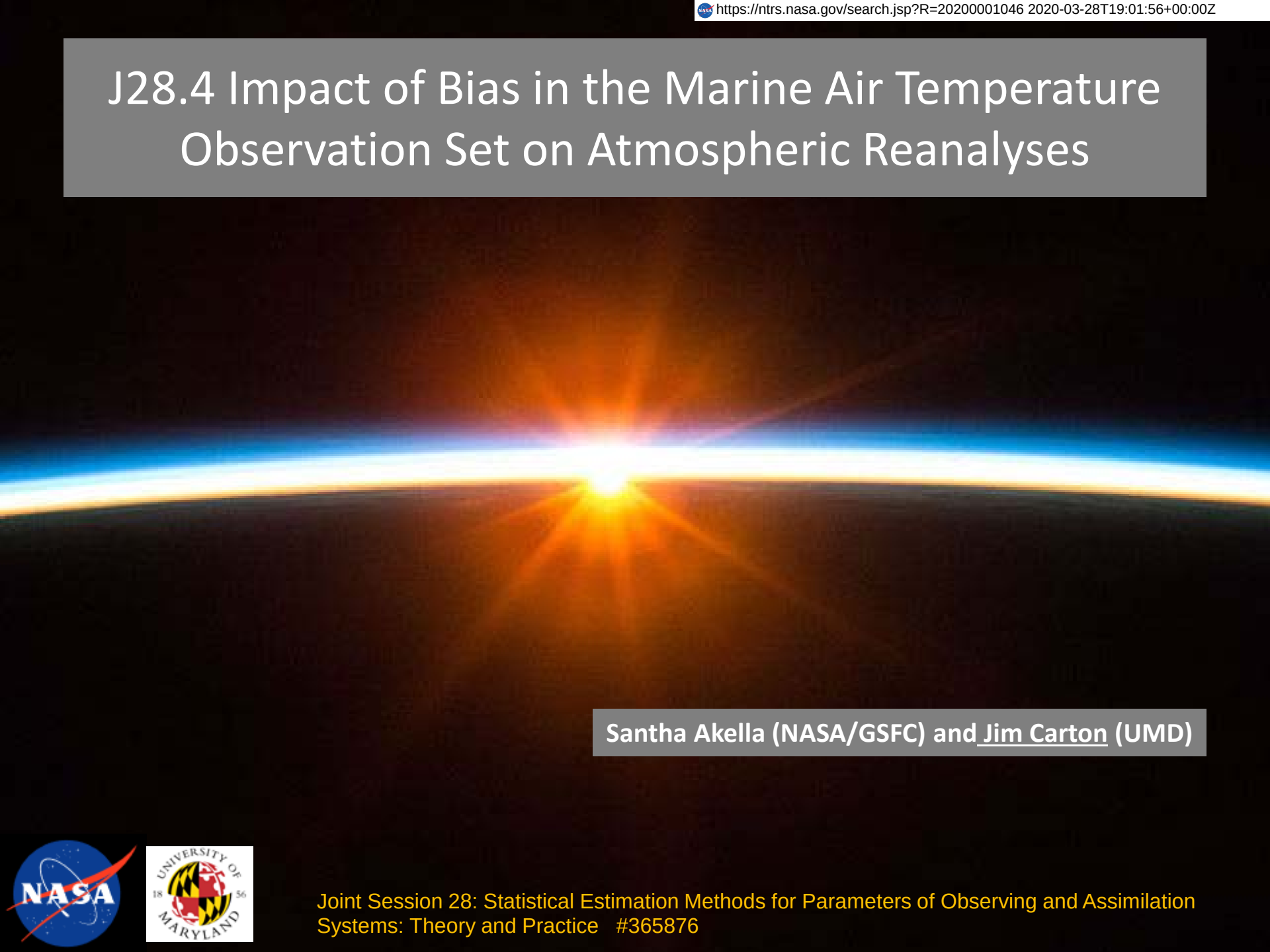
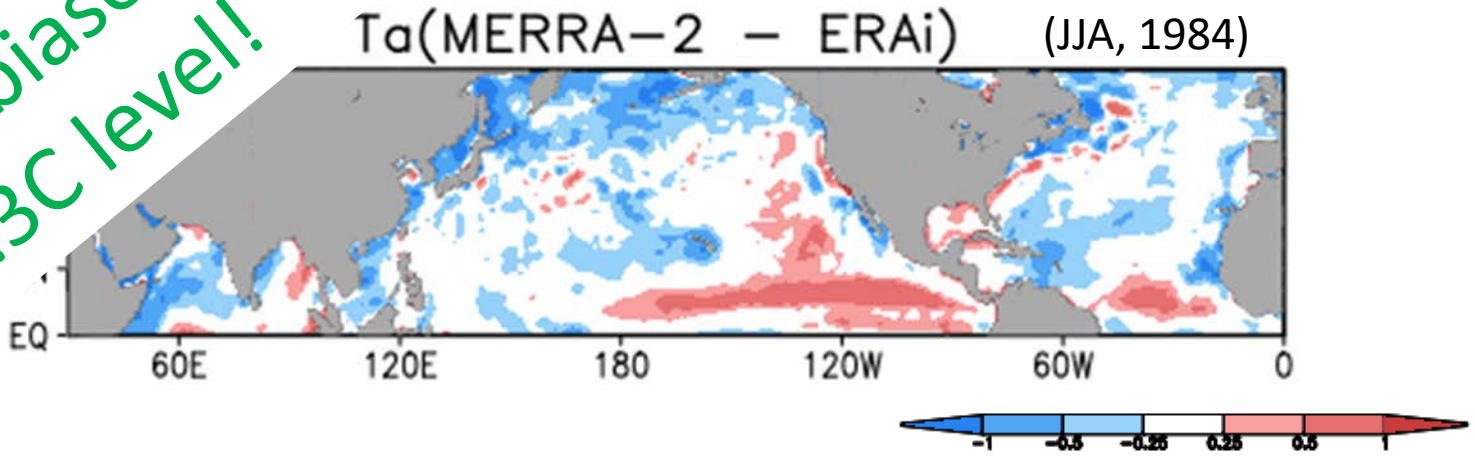
J28.4 Impact of Bias in the Marine Air Temperature Observation Set on Atmospheric Reanalyses



Santha Akella (NASA/GSFC) and Jim Carton (UMD)

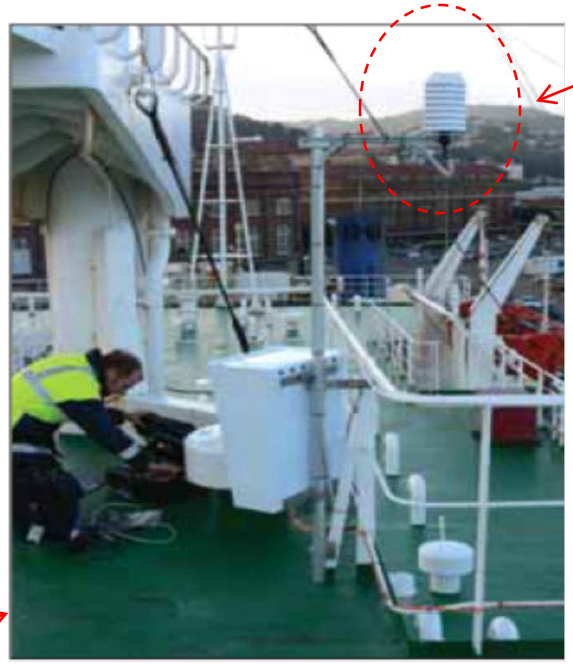
Joint Session 28: Statistical Estimation Methods for Parameters of Observing and Assimilation Systems: Theory and Practice #365876

T_{2m} is biased at 0.3C level!

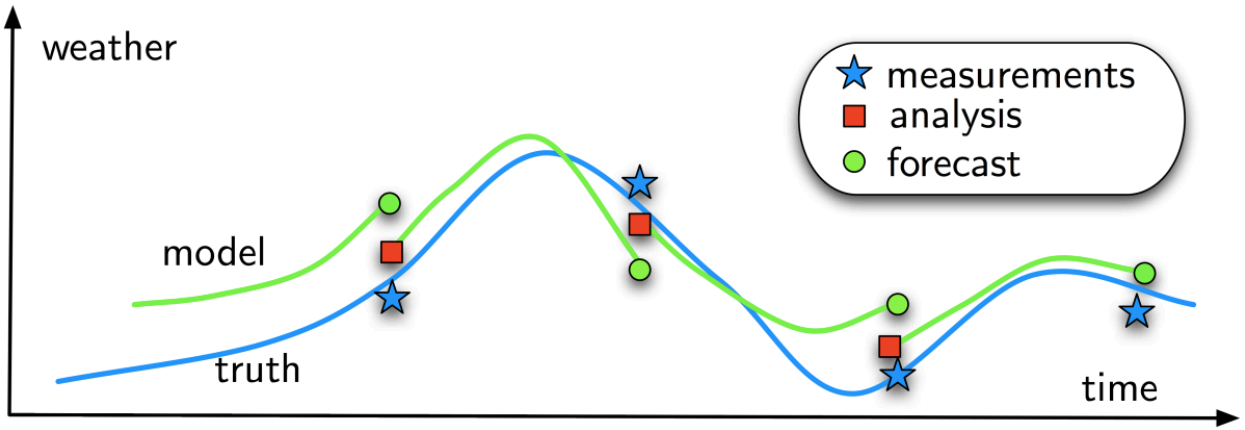


Why we suspect bias in the marine air temperature observation set

Temperature sensor located above a ship's deck



Reanalysis Temperature Tendency Equation

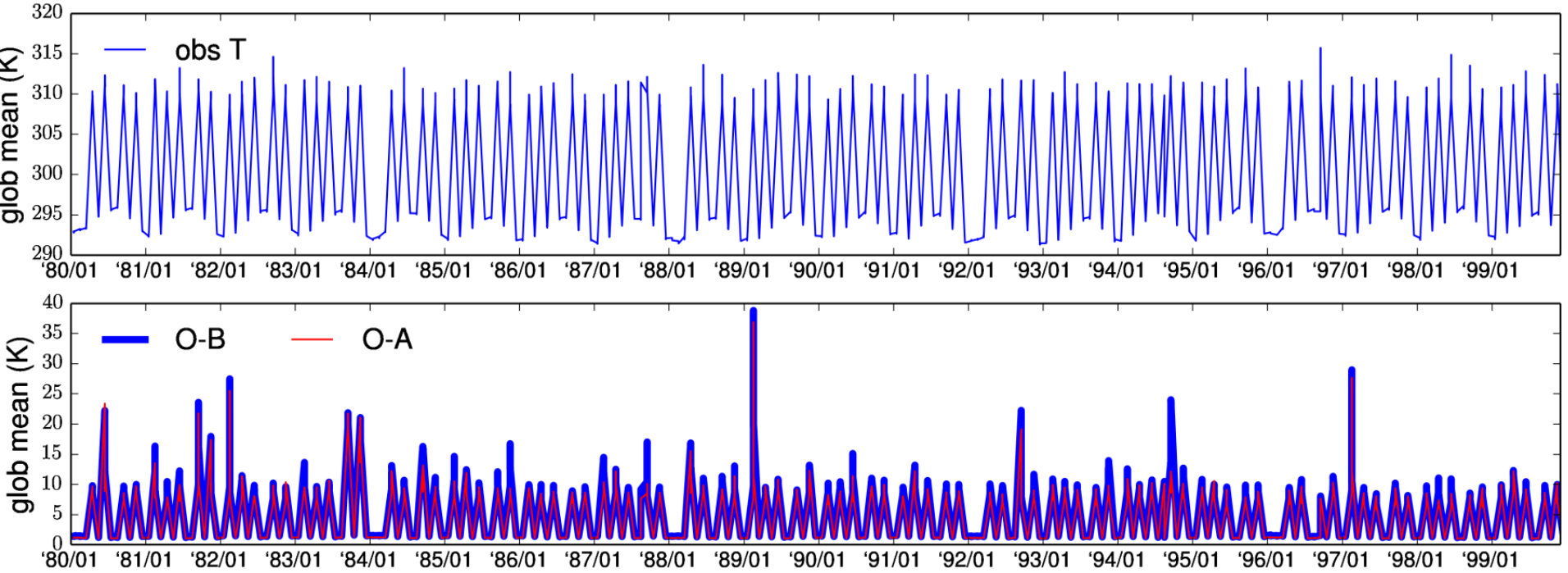


$$\dot{T}_{anal} \equiv \left(\frac{T^o - T^b}{\Delta t}\right)_{anal}$$

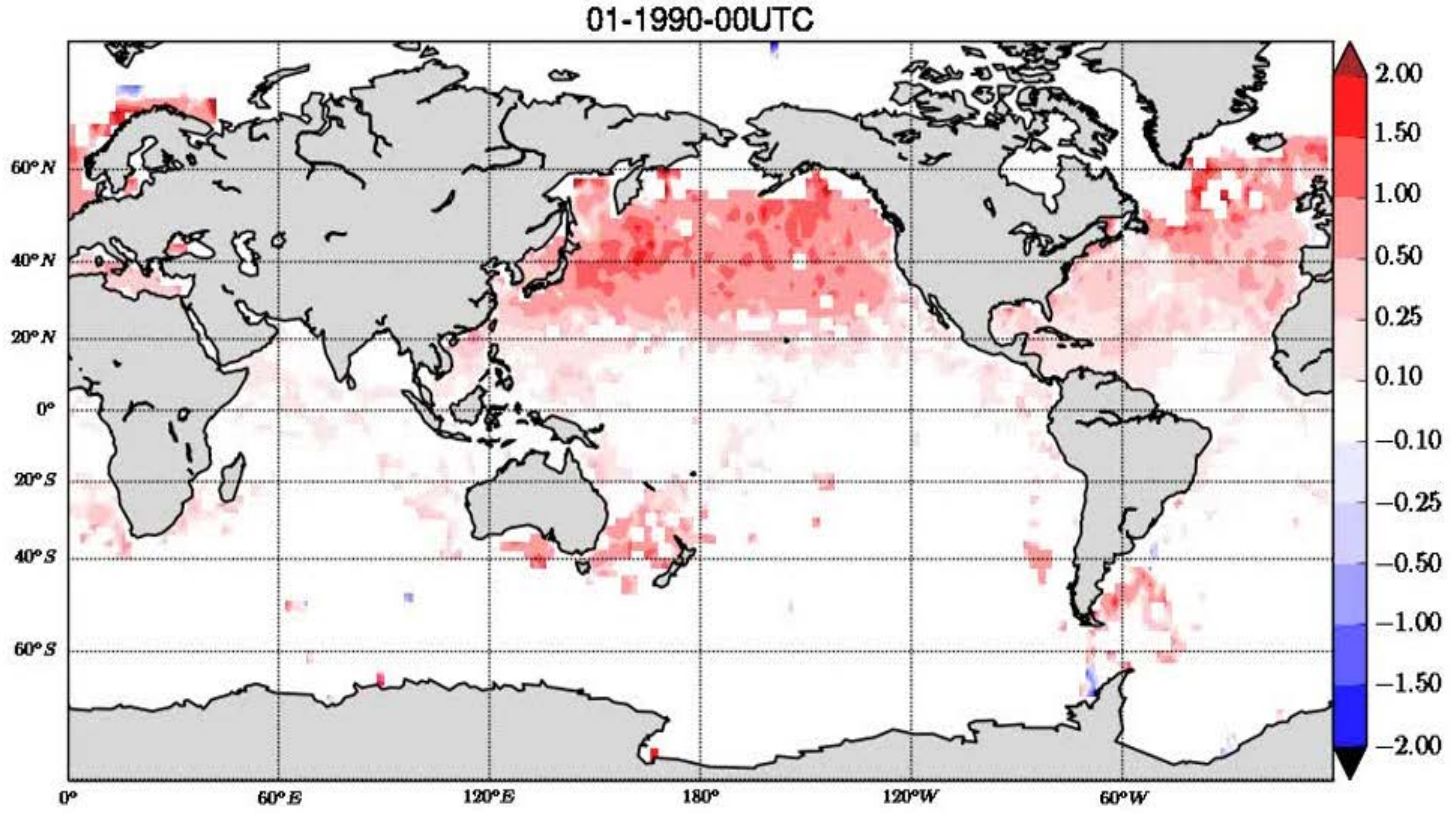
$$\frac{\partial T}{\partial t} = -\vec{U} \cdot \nabla_p T - \omega T \frac{\partial \ln \theta}{\partial t} + \frac{1}{C_p} \frac{DQ_v}{Dt} + \dot{T}_{anal}$$

This talk examines analysis errors

Global T_{2m} (O-B) and (O-A)

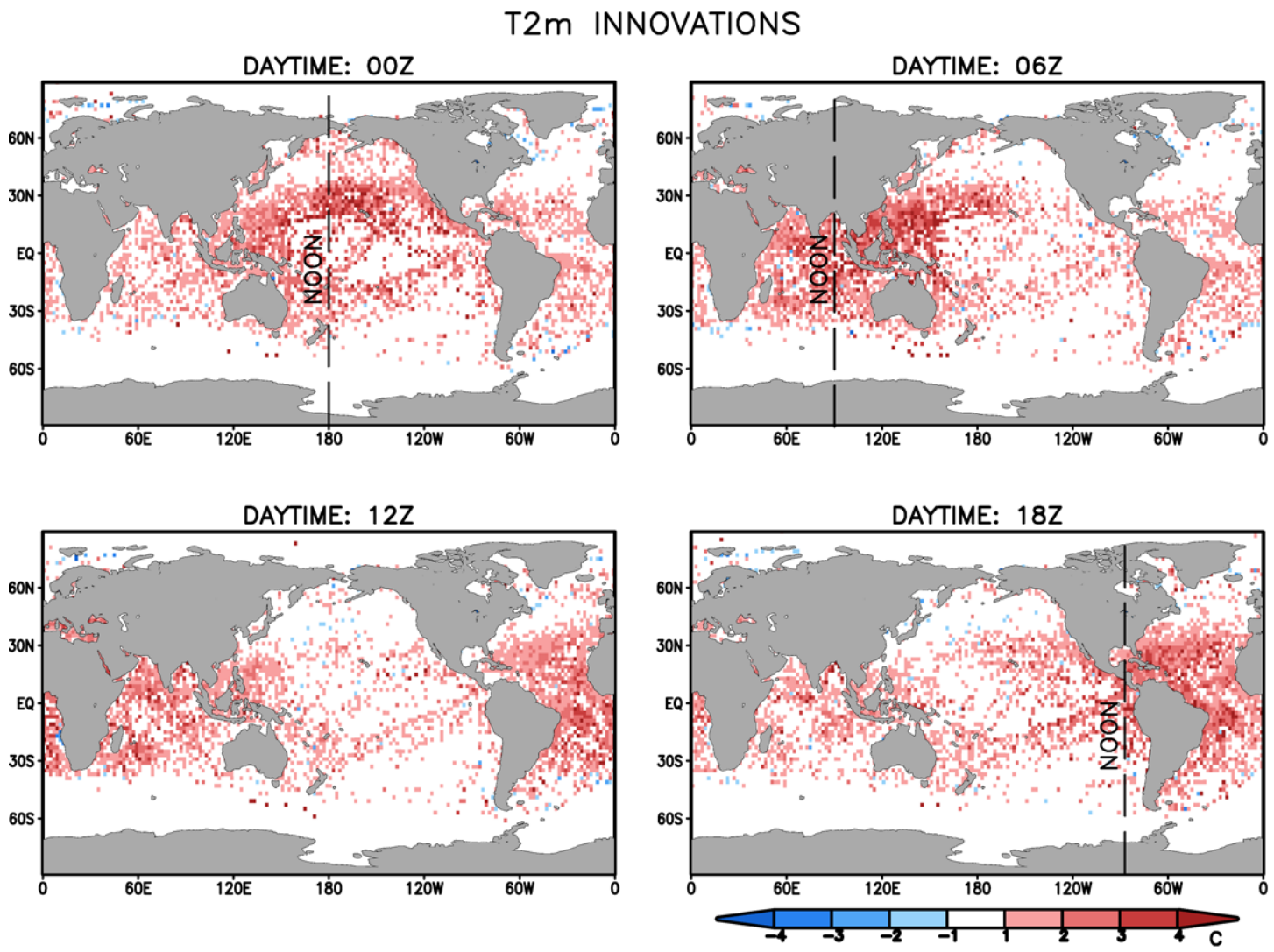


Monthly average of 6hr T_{2m}(O-A)



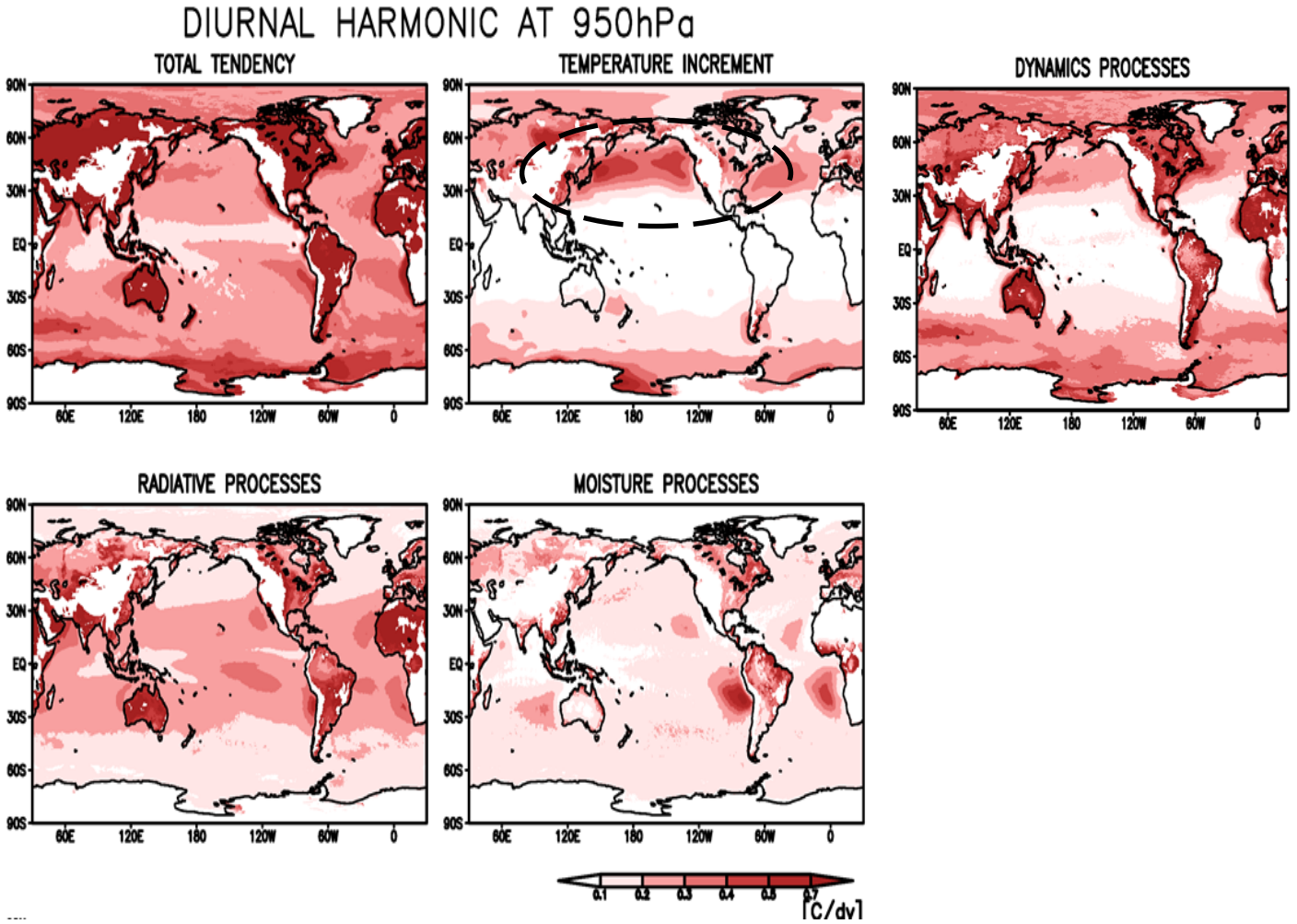
T2m Innovations by day hour

(July, 1983)

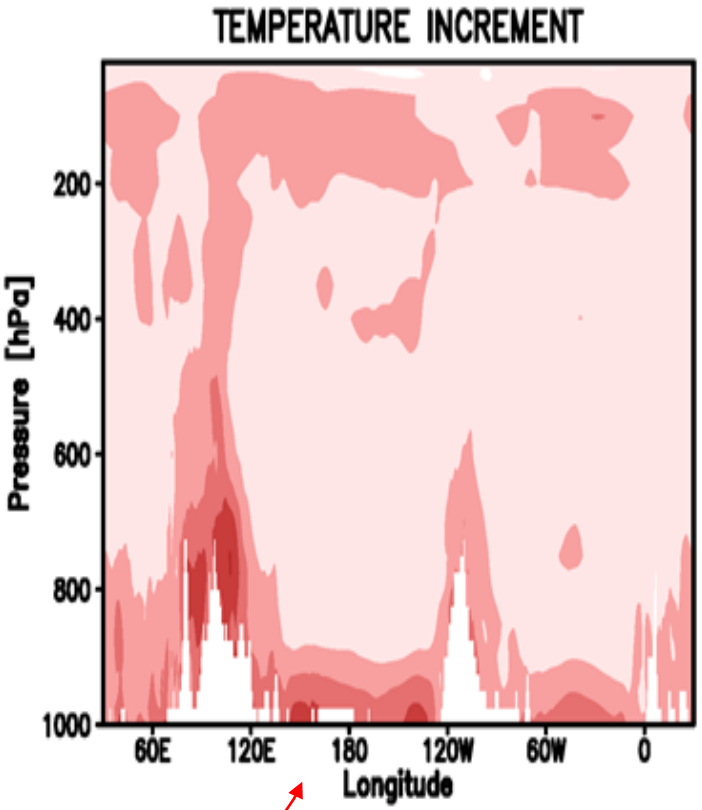


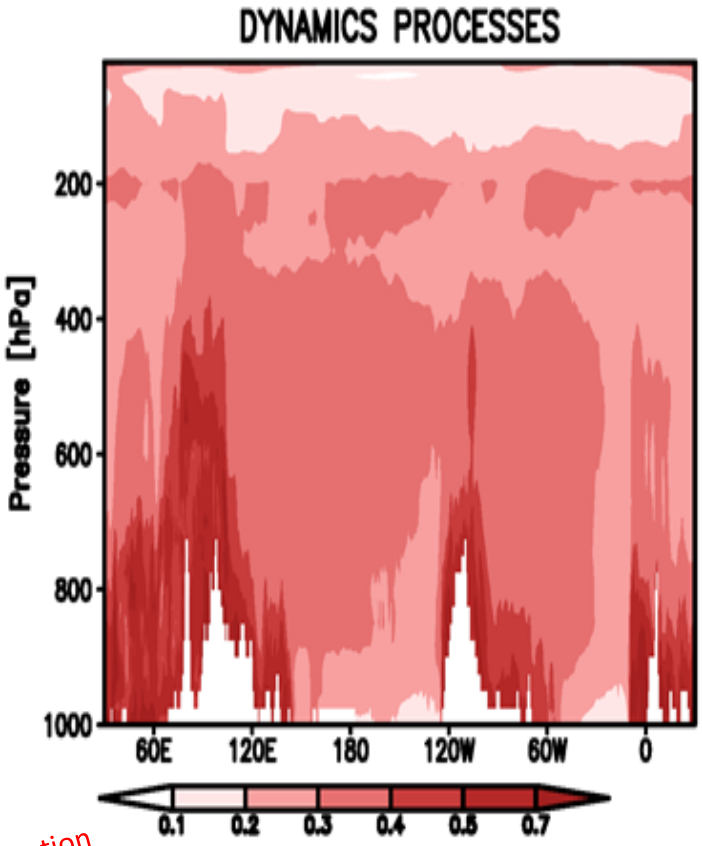
Temperature tendency by component

$$\frac{\partial T}{\partial t} = -\vec{U} \cdot \nabla_p T - \omega T \frac{\partial \ln \theta}{\partial t} + \frac{1}{C_p} \frac{DQ_v}{Dt} + \dot{T}_{anal}$$



Dynamic process v/s Temperature increment along 40°N



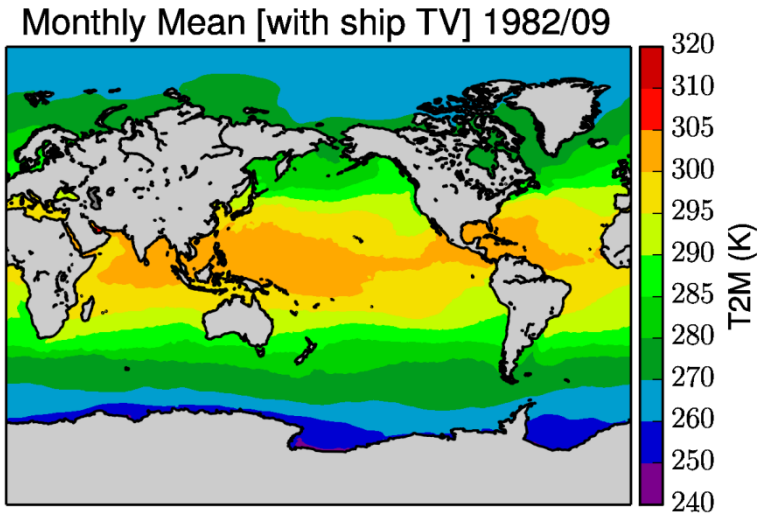


Strongly surface trapped below 900hPa over both land and ocean

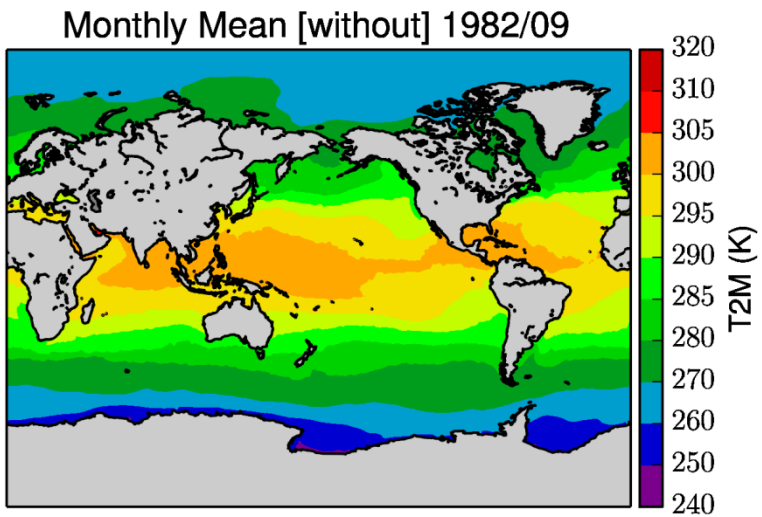
Dynamics contribution maximum 800-400hPa over ocean

Data withholding experiment

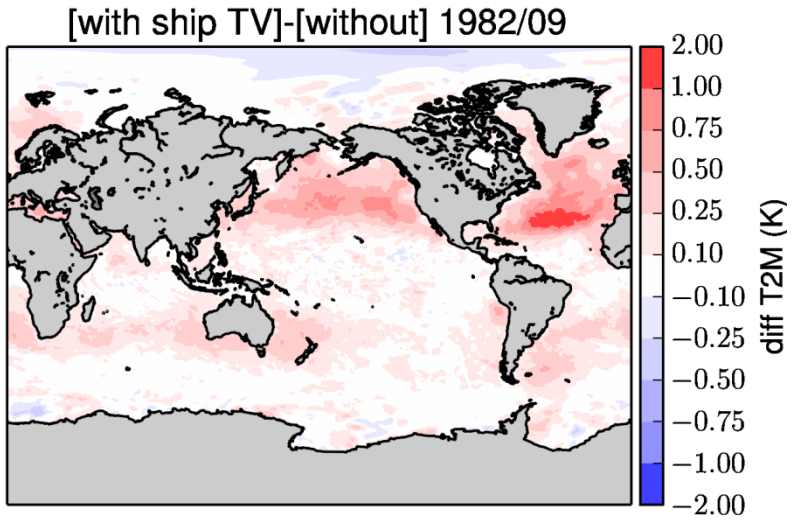
T_{2m} similar to MERRA-2



T_{2m} for the data withholding Expt



Impact on T_{2m} →



Conclusions

- A >0.2°C/dy positive bias in T_{2m} is evident in latitudes 30°N-60°N before year 1995.
  - Bias follows the diurnal cycle, maximum at noon
  - Bias declines after year 2000
- Causes: biased T_{2m} observations and possibly model bias.
- Data withholding experiment: eliminating the T_{2m} observations reduces analysis T_{2m} by 0.5-1°C in the Northern subtropics.